Space Weather Technical Forecast

Issued on Wednesday, 26 June 2024 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Isolated M-class flares likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Has been at Moderate levels, with an isolated low M-class flare, peaking M1 at 25/1245 UTC from AR3723. This is the largest and most complex region on the visible disc, in the southeast quadrant, comprised of a string of small spots, including a weak delta configuration. The remaining regions are smaller, geomagnetic simpler and also generally stable.

A large filament eruption off the west disc was observed around 25/0200 UTC, and an associated CME was observed in STEREO A imagery. Analysis indicates a potential Earth directed component, arriving late day 3 (28th). At present no other Earth directed CME's have been observed in available imagery. However, a long duration C3.7 flare peaking at 25/2204UTC from AR3719 may have produced a CME. If a CME is observed this would likely have an Earth directed component.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed by ACE at L1, were at Background levels, generally below 350 km/s. Density remained below average. Interplanetary Magnetic Field, Bt, was weak until approximately 25/0900 UTC then increased slightly to reach predominantly Moderate levels for the rest of the day, occasionally peaking at 10 nT through the evening. The north-south component, Bz, was mostly weak, but did reach a peak of -8 nT at 25/1314 UTC. Initially negative Bz then become mainly positive from mid-afternoon. The phi angle favoured a negative (southward) direction throughout. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels with no solar radiation storms occurring. High energy electron flux (greater than 2MeV) observed by GOES16 was at background. The 24-hour fluence remained below Active, reaching 1.19e6 integrated pfu by 26/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of further M-flares, with a slight chance of isolated X-class flares. These most likely from AR3723 in the southeast.

Solar Wind / Geomagnetic Activity: A weak enhancement is possible late day 2 (27 Jun) from a very glancing interaction with a filament eruption CME from 23 Jun. Then a further enhancement is possible on late day 3 (28 Jun) from the arrival of the CME from the filament disruption on 25 Jun. This is low confidence however. Otherwise solar winds are expected to remain near background with no notable enhancements forecast. Geomagnetic activity is forecast to be mainly Quiet (Kp 0-2), with only isolated Unsettled (Kp 3) intervals. However, there is a chance of Active to G1/Minor Storm intervals (Kp 4-5) late day 3 (28 Jun).

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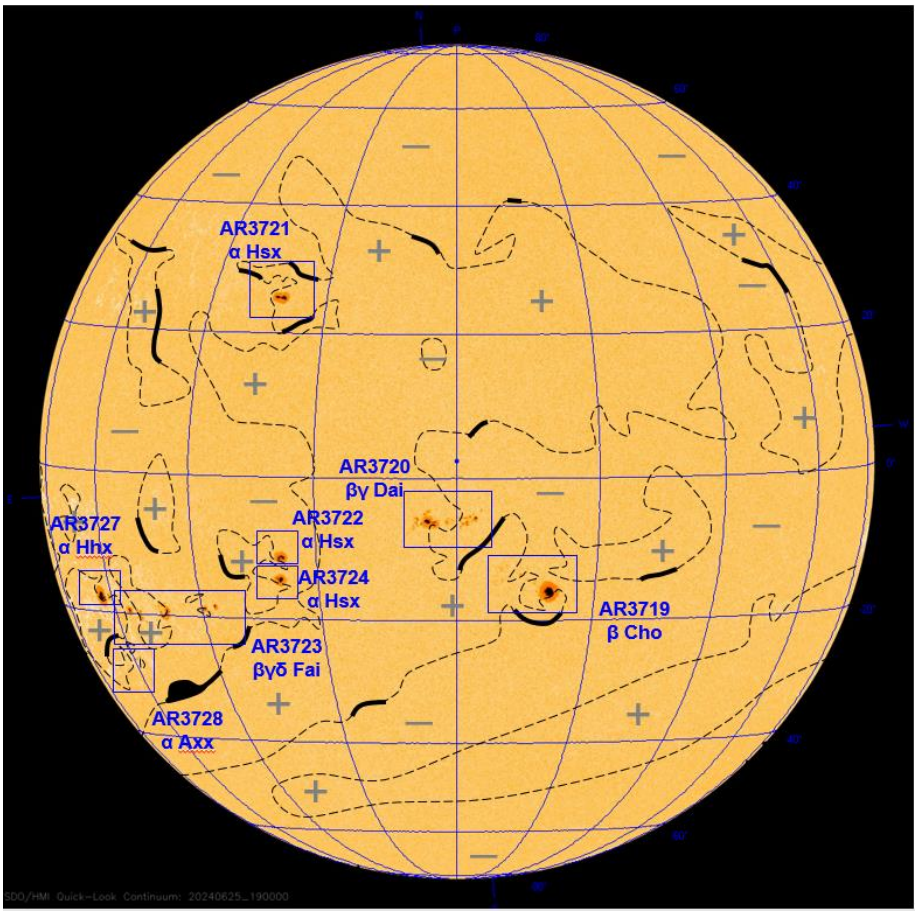
Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels. However, there is an initial slight chance of exceeding the S1/Minor Storm threshold should any notable flares occur from any of the three large sunspots now around the western limb. High energy electron flux is forecast to be at background. The associated 24-hour fluence is expected to remain well below the Active threshold.

Figure 1. Solar Analysis Valid 25/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are two CME's of note. The first, is associated with a filament eruption on 23 Jun and is expected to miss just behind and south of Earth. However, a weak glancing influence cannot be completely ruled out late on day 2 (27 Jun). The second CME is due to the large filament disruption off the west disc early on 25 Jun, resulting in a broad asymmetric partial halo as seen from STEREO A. This CME has been analysed, with a potential Earth directed component possibly arriving late on day 3 (28 Jun). Although the CME was slow, and only a glancing blow is indicated, filament eruption CMEs can be rather dense on arrival, and so there is a chance of G1/Minor geomagnetic storming.

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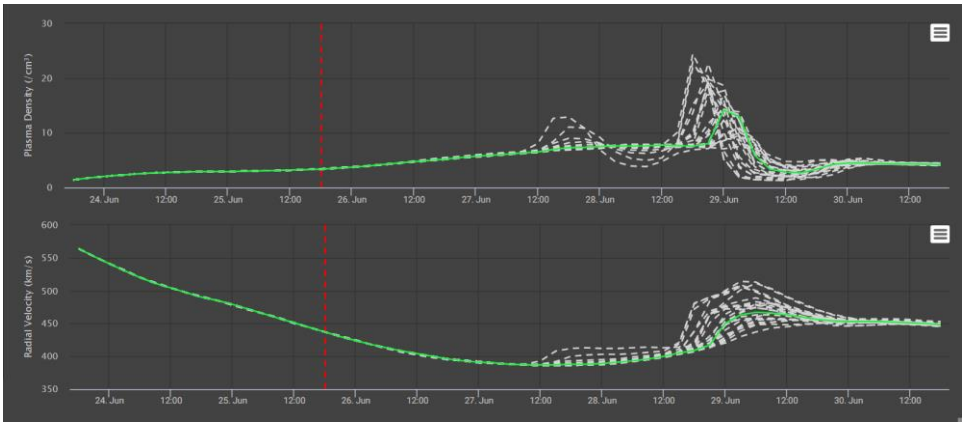
Aside from any CME arrivals, solar winds are expected to remain indicative of a slow background flow with no coronal holes of significance currently on the Earth-facing disc. Solar wind speeds are likely to persist at background with geomagnetic activity forecast to be mainly Quiet, with a chance of isolated Unsettled intervals. The first CME is unlikely to give more than Active intervals, even if an impact is observed. The second CME has the potential to give G1-G2 Minor/Moderate Storms later day 4 (28 Jun).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	40	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
25/1527	Partial	Filament	SW	446	28/2100 UTC	Limited impact

Figure 2: MOSWOC Enlil ensemble showing potential CME arrives.



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Radio Blackouts - X-Ray Flares:

There are eight numbered regions currently on the disc, as AR3728 has been recently numbered, with AR3723 the most significant region. AR3723 is most likely formed from the remnants of AR3697 (and AR3664), and is an unusually long-lived feature that continues to bring a chance of notable flares. A clear delta configuration persists within its intermediate region, and the extensive surrounding plage contributing to this being a bright region on SDO aia-94, although any ongoing growth is minimal. The other regions on the disc are generally simple, mature and stable regions, although some slight growth continues in AR3270 in the south-centre disc, which is now classified as Dai/beta-gamma. Some notable looping is still evident over the southwest limb from AR3712/13 which could still produce observable flares, albeit with a decreasing risk.

There is an ongoing likelihood of further isolated M-class flares, and a slight chance of X-class flares, primarily from AR3723.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	55	55	55	55
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as measured by GOES 18, is expected to remain at background levels. However, there is an initial slight chance of exceeding the S1/Minor Storm threshold should any notable flares occur from any of the three large sunspots now around the western limb. The majority of the current sunspots on the disc persist in the eastern hemisphere, including the most significant region AR3723.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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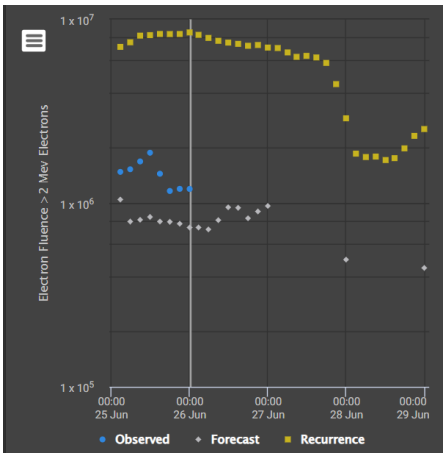
High Energy Electrons Event (≥ 2MeV):

High energy electron flux, as observed by GOES-16, has been at background. With no notable sources of enhancement forecast, flux is expected to persist at this level.
Associated electron fluence is expected to persist well below the Active threshold (1e8 integrated pfu), with MOSWOC REFM output considered to be giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM Model



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